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The information below has been taken from the documentation submitted by Applicant

(54) Procedure and absorption agent for the removal of acid gases from fluids

(57) The invention concerns a procedure acid gases from fluids, in which a fluid flow containing the acid gases is brought into contact with an aqueous absorption agent that contains methyl-diethanolamine and piperazine, in an absorption step, where the total amount of amine lies in the range of 20-70 wt.-% of the absorption agent and the weight ratio of methyl-diethanolamine to piperazine, in the range of 9-15 wt.-%; a fluid stream depleted in acid gases and an absorption agent loaded with acid gases are obtained.

DE 101 39 453 A 1

1

Description

[0001] The present invention concerns a procedure acid gases from fluids. The present invention furthermore concerns the absorption agent itself and its use.

[0002] In numerous processes in the chemical industry accrue fluid flows that contain acid gases, such as CO_2, H_2S, SO_2, CS_2, HCN, COS or mercaptanes as impurities. These fluid flows can for instance be gas flows (such as natural gas, synthesis gas from heavy oil or heavy residues, refinery gas or reaction gases formed in the partial oxidation of organic materials, for instance carbon, or oil; or they can be liquid or liquefied hydrocarbons (such as LPG, liquefied petroleum gas) or LNG (liquefied natural gas). Before these fluids can be transported or processed further, the acid gas content of the fluid must be markedly reduced. For instance, CO_2 must be removed from natural gas, since a high concentration of CO_2 reduces the gross calorific value of the gas. In addition, CO_2 in combination with the water often entrained in the fluid flows can lead to the corrosion of lines and fittings.

[0003] The removal of sulfur compounds from these fluid flows is particularly important for different reasons. For instance, the content in sulfur compounds of natural gas must be reduced directly at the source, by appropriate measures, since sulfur compounds also can form acids that can be corrosive, with the water often entrained. Thus, for the transport of natural gas in a pipeline, established limiting values for sulfur-containing impurities must be satisfied. In addition, numerous sulfur compounds have disagreeable odors even at low concentrations and in particular in the case of H_2S, are toxic.

[0004] It is know d undesired acid gas constituents from fluids by means of gas-washing, or by liquid-liquid extraction with aqueous or non-aqueous mixtures of organic solvents, as absorption agents. Both physical and chemical solvents can be used. Known physical solvents are for instance cyclo-tetramethylene-sulfone (Sulfolan), N-methyl-pyrrolidone and N-alkylated piperidones. Among chemical solvents in particular aqueous solutions of primary, secondary and tertiary aliphatic amines or alkanolamines such as monoethanolamine (MEA), diethanolamine (DEA), monomethyl-ethanolamine (MMEA), diethyl-ethanolamine (DEEA), triethanolamine (TEA), di-isopropanol-amine (DIPA) and methyl-diethanolamine (MDEA), have proven industrially useful. Primary and secondary amines can react with CO_2 forming carbamates. Furthermore, CO_2 can form carbonates and bicarbonates with water; H_2S and water can form sulfides and bisulfides. Due to the presence of primary or secondary amines the equilibria are clearly displaced to the side of ionic products, i.e. more CO_2 can be incorporated in chemically bound form than in water.

[0005] In contrast to primary and secondary alkanolamines, tertiary alkanolamines do not react directly with CO_2, since the amine is fully substituted. Instead, in a slow reaction with water, CO_2 is reacted to bicarbonate. The presence of tertiary amines – just as that of primary and secondary amines – positively influences the position of the equilibrium. Hence tertiary amines are in particular suited to a selective removal of H_2S

2

from gas mixtures that contain CO_2 and H_2S. Because of the slow reaction of CO_2, in the gas washing step, this process must be performed with tertiary alkanolamine solutions with a high liquid:gas ratio, at correspondingly high solvent circulation. It was

hence attempted to increase the absorption rate of CO_2 in aqueous solutions of tertiary amines by addition of other compound, which are called activators or promoters (DE-A 15 42 415, DE-A 10 94 428, EP-A 0 160 203).

[0006] DE 25 51 717 A (US 4,336,233) describes one of the most effective absorption liquids available today for the removal of CO_2 and H_2S from a gas flow. This is an aqueous solution of methyl-diethanolamine (MDEA) and piperazine as absorption accelerator or activator. The absorption liquid described there contains 1.5-4.5 mol/L methyl-diethanolamine (MDEA) and 0.05-0.8 mol/L, preferably up to 0.4 mol/L piperazine. The removal of CO_2 and H_2S using MDEA and piperazine in aqueous solution is furthermore described more precisely in the following patents and patent applications by the applicant: US 4,537,753, US 4,551,158 (EP 121 109) and US 4,553,984, disclosing absorption agents with 20-70 wt.-%, preferably 30-65 wt.-%, especially preferred 40-60 wt.-%, MDEA and 0.1-1 mol/L, preferably 0.2-0.8 mol/L, especially preferred 0.25-0.6 mol/L piperazine. EP 202 600 (CA 1,295,810, EP 190 434 (CA 1,290,553) and EP 159 495 disclose absorption agents with 20-70 wt.-%, preferably 30-65 wt.-%, especially preferred 40-60 wt-% MDEA and 0.05-1 mol/L, preferably 0.1-0.8 mol/L, especially preferred 0.1-0.6 mol/L piperazine. EP 359 991 (US 4,999,031) discloses absorption agents with 20-70 wt.-%, preferably 30-65 wt.-%, especially preferred 35-60 wt.-% MDEA and 0.05-3 mol/L, preferably 0.1-2 mol/L, especially preferred 0.1-1 mol/L piperazine.

[0007] The patents and patent applications mentioned concern improvements in the course of the procedure, i.e. the use of several absorption steps or different variants of the regeneration, with one or more expansion steps, with or without strippers, expansion under a vacuum, etc.

[0008] Application DE 198 28 977 (WO 00/00271) concerns an absorption agent that contains 0.1-50 wt.-% of N heterocycles, such as piperazine, 1-60 wt.-% of an alcohol, 0-60 wt.-% of an aliphatic alkanolamines such as MDEA, 0-98.9% water and 0-35 wt.-% K_2CO_3. The absorption agent has a high absorption rate and high capacity for acid gas constituents. The absorption agents mentioned as examples necessarily contain glycerin.

[0009] The available procedures and absorption agents for the removal of acid gases from fluids contaminated with these gases continue to require considerable solvent circulation and are energy-intensive.

[0010] It is hence a task of the present invention to make available a procedure and an absorption agent for the removal of CO_2 and/or other gases from fluids, in particular gases, that in comparison with the state of the art lead to a considerably reduced energy demand and solvent circulation.

[0011] Surprisingly it was then found that this can be achieved with an aqueous absorption agent that contains methyl-diethanolamine (MDEA) and piperazine in narrowly delimited amounts.

[0012] The object of the present invention is thus a procedure for the removal of acid gases from fluids, in which in an absorption step a fluid flow containing acid gases is brought in contact with an aqueous absorption agent that contains MDEA and piperazine, where the total amount of amine lies in the range of 20-70 wt.-% of the absorption agent and the weight ratio MDEA to piperazine lies in the range of 9-15 wt.-%, obtaining a fluid flow depleted in acid gases and an absorption agent loaded with acid gases.

[0013] Fig. 1 shows schematically a device to carry out the procedure according to the invention with a single step absorption and flash regeneration of the absorption agent.
[0014] Fig. 2 shows schematically a device to carry out the procedure according to the invention with two-step absorption and flash regeneration of the absorption agent.
[0015] Another object of the invention is an absorption agent containing MDEA, piperazine, water and possibly a physically acting solvent, where the total amount of amine is in the range of 20-70 wt.-% of the absorption agent and the weight ratio of MDEA to piperazine lies in the range of 9-15 wt.-%. The object of the invention is also the use of the absorption agent to remove acid gases from fluids, in particular gases.
[0016] In the absorption agent according to the invention MDEA acts as a chemical absorption agent and piperazine as activator. The absorption agent may contain physically acting solvents such as cyclo-tetramethylene-sulfone (Sulfolan) and its derivatives, aliphatic acid amides, NMP (N-methyl-pyrrolidone), N-alkylated pyrrolidones and corresponding piperidones, methanol and mixtures of dialkyl ethers of polyethylene glycols (Selexol, Union Carbide, Danbury Connecticut, US). When present, the physical solvent is preferably there in an amount of up to 30 wt.-%, in particular 0.1-20 wt.-%. It is especially preferred for the absorption agent according to the invention to contain no physical solvent.
[0017] The total amount of amine is preferably of at least 40 wt.-%, in particular 40-60 wt.-%, most especially of 45-55 wt.-%, relative to the absorption agent.
[0018] The weight ratio of MDEA to piperazine lies in the range of 9-15, preferably in the range of 11-15, especially preferred of 13-15. These ranges (as well as all other ranges indicated in the present application) disclose also all intermediate integer and decimal fractions of range, such as 9; 9.1; 9.2; 9.3; ..10; 10.1; 10.2; etc.
[0019] Instead of MDEA it is also possible to use other C_1-C_4-alkyl-di-(hydroxy-C_2-C_4-alkyl)-amines or tri-(hydroxy-C_2-C_4-alkyl)-amines. Some examples are ethyl-diethanolamine, tri-ethanolamine and tri-isopropanolamine.
[0020] Instad of piperazine it is also possible to use other primary and secondary amines, such as monoethanolamine, diethanolamine or di-isopropanolamine.
[0021] The absorption agent according to the invention, or the procedure according to the invention is suitable for the removal of acid gases from fluid flows. The acid gases are in particular CO_2, H_2S, COS and mercaptans. In addition, SO_3, SO_2, CS_2 and HCN can also be removed. Fluids that contain the acid gases are on the one hand gases such as natural gas, synthesis gas, coke-oven gas, coal-gasification gas, "Kreisgas"* and combustion gases, and on the other, liquids essentially not miscible with the absorption

agent, such as LPG or LNG. The gas flows may contain, in addition to one or more of the acid gases mentioned (in what follows called "acid gas components") other, inert gaseous components that are not absorbed to any extent by the absorption agent. Some examples are readily volatile hydrocarbons, preferably C_1-C_4 hydrocarbons such as methane, also nitrogen and hydrogen. The procedure according to the invention is especially suitable for the removal of CO_2 and H_2S.
[0022] The absorption agent according to the invention is generally suitable for the removal from liquids of acid gaseous components that are not themselves absorbed by the absorption agent, and for the extraction of acid gases from liquids that essentially

* Kreisgas in the German original. No English translation found in any dictionary [T.N.]

are not miscible with the absorption agent. Below are described the course of the procedure in principle for gas washing and possible variants that are within the scope of the present invention. The procedure according to the invention can however be transferred by the professional to liquids, without problem. The regeneration of the absorption agent is the same for liquids and gases.

[0023] In an absorption step the starting gas rich in acid gaseous components (raw gas) is brought in contact with an absorption agent according to the invention, whereby the acid gas components are at least partially washed out.

[0024] A washing device customarily used in gas washing procedures is preferably used as absorber. Some examples of suitable washing devices are packings, packed bed and plate columns, radial flow scrubbers, jet scrubbers, Venturi scrubbers, and rotational spray washers; packings, packed bed and plate columns are preferred, packings and packed bed columns are especially preferred. Preferably a column in counter-current is used for the treatment of the fluid flow with the absorption agent according to the invention. Here customarily the fluid is fed into the bottom area and the absorption agent into the upper region of the column.

[0025] In general the temperature of the absorption agent in the absorption step is of approximately 40-100°C and if a column is used, for instance of 40-70°C at the head of the column and of 50-100°C at its bottom. In general the overall pressure in the absorption step is of approximately 1-120 bar, preferably of 10-100 bar. A product gas (pure gas), depleted in acid gas components, is obtained, and an absorption agent loaded with acid gaseous components.

[0026] The procedure according to the invention may comprise one or more, in particular two, sequential absorption steps. Absorption may occur in several sequential partial steps, in which the acid components-containing raw gas is in each partial step put in contact with a partial flow of the absorption agent. The absorption agent with which the raw is contacted may already be partially loaded with acid gases, i.e. it may for instance be an absorption agent recirculated from a subsequent absorption step to the first absorption step, or a partially regenerated absorption agent. Regarding the realization of the two-step absorption, we refer to the documents EP-A 0 159 495, EP-A 0 190 434, EP-A 0 359 991 and WO 00/00271.

[0027] According to a preferred implementation form, the procedure according to the invention is carried out such that the fluid containing the acid gases is treated with the

absorption agent in a first absorption step, at a temperature of 40-100°C, preferably of 50-90°C and in particular, of 60-90°C. The fluid impoverished in acid gases is then treated in a second absorption step with an absorption agent at a temperature of 30-90°C, preferably of 40-80°C and in particular, of 50-80°C. Here the temperature is of 5-20°C lower than in the first absorption step.

[0028] The acid gaseous components can be removed from the acid gas components-loaded absorption agent in the usual manner (similar to that in the publications cited below), in a regeneration step, in which a regenerated absorption agent is obtained. In the regeneration step the loading of the absorption agent is reduced and the regenerated absorption agent obtained is then preferably next returned to the absorption step.

[0029] In general the regeneration step includes at least one pressure relief for the loaded absorption agent, from the high pressure existing during the realization of the absorption step, to a lower pressure. The expansion may be accomplished by means of a throttle valve and/or a pressure relief turbine. Regeneration with an expansion step is for instance described in the documents US 4,537,753 and US 4,553,984.

[0030] The release of the acid gas components in the regeneration step can for instance occur in a pressure-release column, for instance in a vertically or horizontally arranged flash container, or in a countercurrent column with baffles. Several pressure-release columns can be arranged in series, in which the regeneration occurs at different pressures. For instance, in a pre-expansion column at high pressure, typically of approx. 1.5 bar above the partial pressure of the acid gas components in the absorption step, and in a main expansion column at low pressure, for instance at 1-2 bar absolute. Regeneration in two or more expansion steps is described in the documents US 4,537,753, US 4,553,984, EP-A 0 159 495, EP-A 0 202 600, EP-A 0 190 434 and EP-A 0 121 109.

[0031] A procedural variant with two low-pressure expansion steps (1-2 bar absolute) in which the absorption liquid partially regenerated in the first low-pressure expansion step is heated, and where possibly an intermediate expansion step is provide prior to the first low-pressure expansion step, in which pressure is reduced to at least 3 bar, is described in DE 10 02 8637. Here the loaded absorption liquid is first relieved to a pressure of 1-2 bar (absolute) in a first expansion step. Next the partially regenerated absorption liquid is heated in a heat exchanger and then depressurized again in a second low pressure expansion step to a pressure of 1-2 bar (absolute).

[0032] The last expansion step can also be performed under a vacuum, for instance generated by means of a steam jet, possibly in combination with a mechanical generation device, as described in EP-A 0 159 495, EP-A 0 202 600, EP-A 0 190 434 and EP-A 0 121 109 (US 4,551,158).

[0033] Stripping may be in addition performed in the regeneration step, where further acid gas constituents are release from the absorption agent. Stripping can also be accomplished in one or several steps. Stripping can be performed in an adsorption

column equipped as packed bed or with packings. The pressure here is preferably of 1-3 bar absolute, at a temperature of 90-130°C, stripping with hot gas or steam, preferably with steam. Procedures in which additional stripping is performed are described in EP-A 0 159 495, EP-A 0 190 434 and EP-A 0 359 991.

[0034] To balance the water losses due to the water lost in the gas flows removed, it is possible to add steam, for instance to the sump of a decompression step, as described in EP-A 0 159 495 and US 4,551,158 (EP-A 0 121 109).

[0035] The regeneration step can be carried out in accordance with one of the procedural variants described in WO 00/00271, in several sequential partial steps, where the absorption agent obtained from the successive partial steps shows a decreasing load with acid gaseous components. For instance, in a pressure relief column a first part of the acid gas from the loaded absorption agent can be released, followed by stripping, where further acid gas components are released and the absorption agent is substantially regenerated. It is also possible to regenerate in several sequential pressure relief columns, or in several sequential pressure relief columns and in addition, in a stripper. For instance, as described in DE-A 25 51 717, a rough wash can be carried out with a pure expansion circuit, where the loaded absorption agent is depressurized in a pressure relief turbine and is then stepwise regenerated in a pre-depressurization column and a main pressure relief column.

[0036] In multiple-step absorption and regeneration it is preferred that the partial flows of absorption agent used in the sequential partial steps of the absorption step exhibit a decreasing load of acid gas constituents. Here a procedure is especially preferred in

which the starting gas containing the acid gas constituents be placed sequentially in contact with a first partial flow of the absorption agent, which after partial regeneration in a pressure relief column and prior to stripping, is placed in contact with a second partial stream of the absorption agent, obtained after stripping.

[0037] For instance, as described in DE-A 25 51 717, the absorption step can be performed in two partial steps – a coarse and a fine wash – and the regeneration step stepwise, by pressure relief in an expansion turbine, a pre-depressurization column and a main pressure relief column with subsequent stripping, where the partial flow for the coarse wash comes from the main pressure relief column and the partial flow of absorption agent for the fine wash comes from stripping.

[0038] Procedures with multi-step absorption and regeneration with low-pressure expansion and stripping are especially preferred , as well as the procedural variant described in EP-A 0 359 991, with multi-step absorption, one or several expansion steps and stripper. In one of the procedures described the expanded gas removed at the head of a pressure relief column is condensed in a compressor and added to the starting gas to be purified in the first absorption step.

[0039] Because of the optimum balance in the contents of MDEA and piperazine, the absorption agent according to the invention exhibits high loadability with acid gases, which can also be easily desorbed again. Because of this, in the procedures according to the invention energy consumption and solvent circulation can significantly reduced.

[0040] The procedure according to the invention is elucidated below by means of **Figs.** 1 and 2. **Fig.** 1 shows schematically a device in which the absorption process is single-step and the pressure relief takes place in two steps. The feed gas is supplied through line **1** to bottom area of absorber **2**. Absorber **2** is a packed bed column to effect the mass and heat exchange. The absorption agent, a regenerated absorption agent with a low residual content in acid gases, is sent through line **3** to the head of absorber **2** in countercurrent to the fed gas. The gas depleted in acid gases leaves absorber **2** over the head (line **4**). The absorption agent enriched in acid gases leaves absorber **2** at the bottom, through line **5** and is sent to the upper region of the high-pressure expansion column **6**, which is generally operated at a pressure above the CO_2 partial pressure in the raw gas fed into the absorber. The expansion of the absorption agent in general takes place using the customary devices, for instance a level control valve, a hydraulic turbine or an inversely running pump. During expansion most of the dissolved non-acid gases are released, as well as a small part of the acid gases. These gases are removed over top of the high-pressure depressurization column **6**, through line **7**.

[0041] The absorption agent, which continues to be loaded with the bulk of the acid gases, leaves the high-pressure depressurization column through line **8** and is heated in the heat exchanger **9**, where a small part of the acid gases may be released. The heated absorption agent is fed into the upper region of a low-pressure depressurization column **10**, equipped with a packed bed, to attain a large surface area to achieve the release of CO_2 and establish the equilibrium. In the low-pressure depressurization column **10**, the bulk of CO_2 and of H_2S are practically entirely released by flashing. In this manner the absorption agent is simultaneously regenerated and cooled. At the head of the low-pressure depressurization column **10** a reflux container **11** is provided, with a collection container **12**, to cool the acid gases released and to condense part of the steam. The bulk of the acid gases leaves the reflux cooler **11** over lien **13**. The condensate is returned to the head of the low-pressure depressurization column **10** by means of pump **14**. The

regenerated absorption agent, which still contains a small part of CO_2, leaves the low-pressure depressurization column **10** at the bottom through line **15** and is returned to the head of absorber **2** through pump **16** over line **3**. Freshwater can be fed through line **17** to compensate for the water removed with the gases.

[0042] **Fig.** 2 shows schematically a device to perform the procedure according to the invention using a two-stage absorber and a two-step expansion. The absorber comprises a raw absorber **1** and a pure absorber **2**. The feed gas is fed to the lower part of raw absorber **1** through line **3** and treated in countercurrent with regenerated absorption agent, which is placed through line **4** onto the top of raw absorber **1** and still contains some acid gases. Regenerated absorption agent is place at the head of pure absorber **2** through line **5** and essentially no longer contains acid gases. Both parts of the absorber

contain a packing to cause mass and heat exchange between raw gas and absorption agent. The treated gas leaves the pure absorber **2** over the head (line **6**). The absorption agent loaded with acid gases is removed at the bottom of raw absorber **1** and is fed into the top of the high-pressure depressurization column **8**. Column **8** is equipped with packing and is operated at a pressure that lies between the pressure in the absorber and that of the downstream low-pressure depressurization column **11**. The expansion of the absorption agent loaded with aid gases is accomplished by means of the usual devices, for instance a level control valve, a hydraulic turbine, or a pump operating in reverse. During high-pressure expansion the greatest part of the dissolved, non-acid gases and a small part of the acid gases is released. These gases are removed over the top of the high-pressure depressurization column **8** through line **9**.

[0043] The absorption agent, which still is loaded with the bulk of the acid gases, leaves the high-pressure depressurization column **8** through line **10** and is fed into the upper portion of the low-pressure depressurization column **11** ,where the bulk of CO_2 and H_2S are released by flashing. The absorption agent is regenerated in this way. The low-pressure depressurization column **11** is equipped with packing to prepare a large surface for the heat and mass transfer. At the head of the low-pressure depressurization column **11** a reflux cooler **12** is installed, with condensate container **13**, to cool the acid gases leaving over the head of the low-pressure depressurization column **11** and to condense part of the steam. The gas not condensed, which contains the bulk of the acid gases, is removed via line **14**. The condensate in condensate container **13** is returned through pump **15** to the head of the low-pressure depressurization column **11**.

[0044] The partially regenerated absorption agent that still contains part of the acid gases, leaves the low-pressure depressurization column **11** at the bottom, through line **16** and is split into two partial flows. The larger partial flow is sent through pump **17** and line **4** to the head of raw absorber **1**, while the smaller one is sent for heating through line **18** by means of pump **19** to heat exchanger **20**. The heated absorption agent is then fed into the upper portion of stripper **21**, equipped with packing. In stripper **21** the bulk of the absorbed CO_2 and H_2S is stripped by means of steam generated in reboiler **22** and fed into the bottom part of stripper **21**. The absorption agent leaving the bottom of stripper **21** through line **23** has only a small residual content of acid gases. It is sent through heat exchanger **20**, where the partially regenerated absorption agent coming from the low-pressure depressurization column **11** is heated. The cooled, regenerated absorption agent is sent back to the head of pure absorber **2** by means of pump **24** via heat exchanger **25**. Fresh water can be added to the head of pure absorber **2** through line **26**, to replace the water removed by the gas flows. The gas leaving stripper

21 over the head is fed to the lower portion of the low-pressure depressurization column **11** through line **27**.

[0045] The examples below elucidate the invention, without limiting it.

Example 1

[0046] To perform the procedure according to the invention, an absorption agent is

suitable that relative to the total weight of the agent contains 40 wt.-% MDEA and sufficient piperazine so that the weight ratio of the former to the latter is of **12.5**.

[0047] In comparison to an absorption agent with the same MDEA content, but that contains sufficient piperzine so that their weight ratio is of **16**, The absorption agent according to the invention exhibits reduced energy consumption and solvent circulation.

Patent claims

1. Procedure for the removal of acid gases from fluids, in which in an absorptions step a fluid flow containing acid gases is brought into contact with an aqueous absorption agent that contains methyl-diethanolamine and piperzine, where the total amount of amine is in the range of 20-70 wt.-% relative to the absorption agent and the weight ratio of MDEA to piperzine lies in the range of 9 to 15, where a fluid flow depleted in acid gases and an absorption agent loaded with acid gases are obtained.

2. Procedure according to claim 1, **characterized by** using an absorption agent in which the total amount of amine lies in the range of 40-60 wt./% of the absorption agent.

3. Procedure according to claim 2, **characterized by** using an absorption agent in which the total amount of amine lies in the range of 45-55 wt.-% of the absorption agent.

4. Procedure according to one of the claims 1 through 3, **characterized by** using an absorption agent in which the weight ratio of DMEA to piperzine lies in the range of 11-15.

5. Procedure according to claim 4, **characterized by** using an absorption agent in which the weight ratio of DMEA to piperzine lies in the range of 13-15.

6. Procedure according to one of the claims 1 through 5, **characterized by** the absorption step being performed in at least two sequential partial steps.

7. Procedure according to one of the claims 1 through 6, **characterized by** a regeneration step being performed in addition, in which the acid gases are released from the loaded absorption agent, where a regenerated absorption agent is obtained which, if desired, may be returned to the absorption step.

8. Procedure according to claim 7, **characterized by** the regeneration step comprising one or more expansion steps.

9. Procedure according to steps 7or 8, **characterized by** the regeneration step comprising one or more stripping steps.

10. Aqueous absorption agent containing methyl-diethanolamine and piperzine, where the total amount of amine lies in the range of 25-65% relative to the absorption agent and the weight ratio of MDEA to piperzine lies in the range of 9-15.

11. Utilization of the absorption agent according to claim 10 for the removal of acid

gases from fluids.

In addition 2 pages of drawings

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Fig. 1

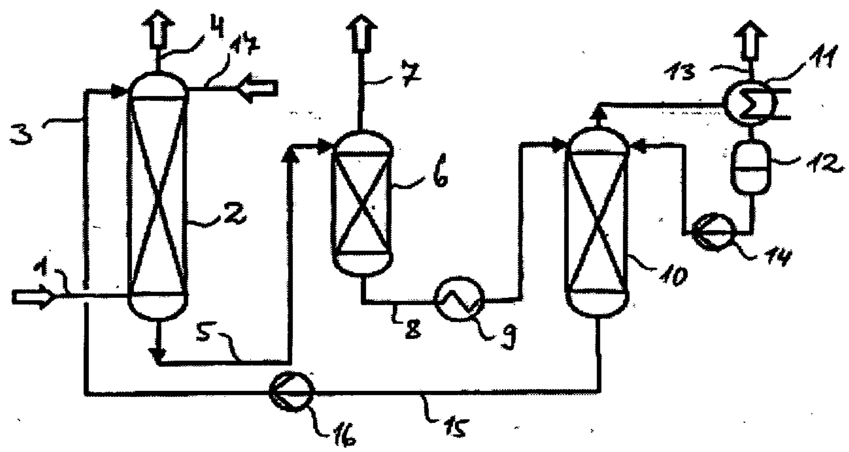

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Fig. 2